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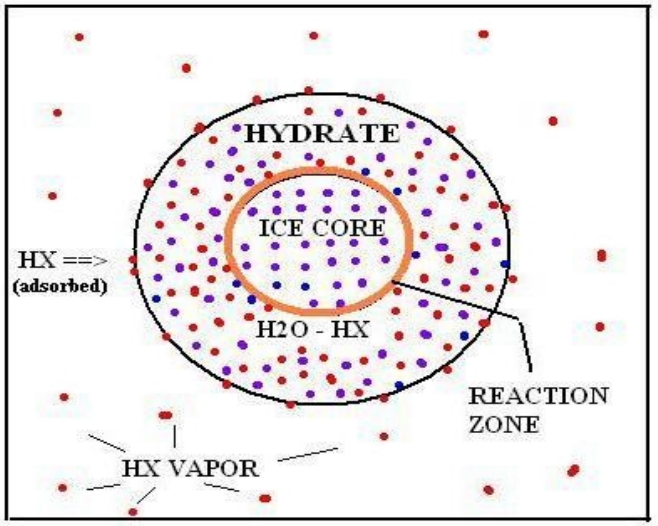
It is common for particles of the atmosphere to convert to a new substance through interaction with the trace gases present. An example is the conversion of ice particles of earth's polar stratosphere to acid-hydrate particles; one factor in ozone-hole chemistry. These conversions can be understood using a shrinking-core particle-reaction scheme. In this model, **as diagramed**, adsorbed acid vapors (HX) react with an ice particle, forming a crust of hydrate. Once formed this crust often controls the reaction, since the HX molecules must diffuse through the crust to reach the reaction zone at the ice-hydrate interface. We measure the rates of such conversions through infrared spectroscopy of 3-dimensional arrays of ice nanocrystals exposed to acid vapors. Our results include quantitative values for the rate of diffusion of HX through many different hydrates, and a strong indication that, contrary to established views, such particle conversions do not involve any acid diffusion within the ice itself.



Cartoon of the conversion of an ice particle by uptake of acid HX from the vapor phase.